THE VEGETATION OF KOONAMORE STATION, SOUTH AUSTRALIA

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SUMMARY

A vegetation map of Koonamore Station in the arid zone of South Australia is presented. Six vegetation forms or sub-forms (semi-arid mallee, arid scrub, low arid scrub, low arid woodland, shrub steppe, and ephemeral herb and grassland) and 15 plant associations are described for the Station. These are correlated with the landscape and soils on which they are found.

A list showing the ecological distribution of 196 native and 16 alien species recorded on the survey is appended.

INTRODUCTION

Koonamore Station is located in the arid zone of South Australia, approximately 40 miles north of Yunta, a small town 200 miles north of Adelaide on the Broken Hill railway line (Fig. 1). A vegetation reserve, a little more than one mile square, was established near the centre of the property by the University of Adelaide in 1925. The present survey of Koonamore Station, an area of 472 square miles, was undertaken to ascertain the degree to which Koonamore Vegetation Reserve (Osborn, 1925; Osborn *et al.*, 1931, 1932, 1935; Wood, 1936; Hall *et al.*, 1964) is representative of the soils and vegetation of the surrounding countryside.

A base map of the Station showing fence lines, tracks, hills, watercourses, salt pans and other landmarks was prepared from aerial photographs. Land traverses by motor vehicle, using odometer distances, were then made to record in detail changes in vegetation along all the roads and tracks on the property, and, where necessary, along cross-country routes. Because of the relatively open nature of the landscape, these traverses were sufficiently close together to allow the plotting of most vegetation boundaries in the field. However, in a few areas, aerial photographs were used to locate these boundaries.

Soil profiles were examined at frequent intervals, usually wherever changes in vegetation were noted, and six intergrading groups of soils are recognised. Six vegetation forms or sub-forms, and 15 plant associations are described for the Station. The landscapes and soils on which these associations are found are summarised in Table 1. Appendix I is a list of 196 native and 16 alien species and the habitats in which they were recorded on the survey. Popular names for the more common plants referred to in the section on Vegetation are listed in Appendix II.

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TABLE I. *Ecological relationships of the vegetation on Koonamore Station.*

Vegetation				Soils	
Form/Sub-Form	Association	Topography	Geology	Group Name	Classification (Northcote, 1960)
I. Semi-arid mallee sub-form	Eucalyptus oleosa	Deep sand dunes over well developed limestone layer.	Quaternary alluvial and aeolian deposits	Bindyeye	Uc 5.12 (deep surface soil)
		Creek-beds and rocky slopes of adjacent hills.		Oopina	Um 5.11
II. Arid scrub sub-form	*Acacia aneura* (often with *A. burkittii*)	Deep sand dunes with poorly developed limestone layer.	Quaternary alluvial and aeolian deposits.	Bindyeye	Uc 5.11 (deep surface soil)
III. Low arid scrub sub-form	*Acacia burkittii* *Eremophila sturtii*	Low sand dunes.	Quaternary alluvial and aeolian deposits.	Bindyeye	Uc 5.11 (deep surface soil)
	Eremophila spp. *Dodonaea* spp.	Creeks and rock strike lines in hills wherever rainfall is concentrated.	Precambrian shales and tillites	Hills	Um 5.12
IV. Low arid woodland sub-form	*Casuarina cristata* (some *Acacia aneura*)—*Kochia sedifolia*	Creeks and rock strike lines in hills wherever rainfall is concentrated.	Precambrian shales and tillites	Hills	Um 5.12
	Casuarina cristata (with *Atriplex* spp. *Kochia sedifolia* or *Stipa nitida*)	Sand plain	Quaternary alluvial and aeolian deposits.	Bindyeye	Uc 5.12 and Gc 1.12
	Myoporum platycarpum and/or *Heterodendrum oleifolium*—*Atriplex vesicaria*	Plains	Quaternary alluvial and aeolian deposits.	Bindyeye	Gc 1.12
	Myoporum platycarpum—*Eremophila longifolia* (also *Heterodendrum oleifolium*)	Flood plains between dunes.	Quaternary alluvial and aeolian deposits.	Bindyeye	Gc 1.12 (periodically flooded)
	Myoporum platycarpum *Nitraria schoberi*	Low rises in drainage basins.	Quaternary alluvial and aeolian deposits.	Lakes	Saline Gc 1.12 (often with gypsum-"Kopi" in profile)

V. Shrub steppe form	*Atriplex vesicaria*	(*a*) low hills and rolling plains (*b*) broad drainage lines from hills.	Precambrian shales and tillites	Oopina Oopina	(*a*) Um 5.11 (*b*) Dr 1.33
	Kochia sedifolia	(*a*) Broken, rocky hills or flats of small area dissected by creek beds (*b*) Plains between Oopina and Koonamore Hills (*c*) Outwash plains to north of Koonamore Hills.	(*a*) Precambrian shales and tillites (*b*) Quaternary alluvial and aeolian deposits (*c*) Quaternary alluvial and aeolian deposits	Hills Bandyeye Nillinghoo	(*a*) Um 5.11-12 (*b*) Gc 1.12 (Limestone layer varies from almost absent to almost solid) (*c*) Gc 1.22
	Kochia astrotricha	Saddle through Oopina Hills. Lower slopes of Orama and Koonamore Hills Plains to north of Koonamore Hills.	Quaternary alluvial and aeolian deposits from Precambrian shale outcrops.	Oopina and Curnamona	Probably Um 5.11 or Gc 1.22
	Nitraria schoberi – *Kochia pyramidata*	Drainage systems	Quaternary alluvial deposits.	Lakes	Saline Gc 1.12
	Arthrocnemum halocnemoides – *Pachycornia tenuis*	Low lying drainage basins.	Quaternary alluvial deposits.	Lakes	Uf 6.61
VI. Ephemeral herb and grassland sub-form	*Stipa nitida* – *Bassia* spp.	Low, gentle slopes at edge of drainage systems (Oopina Hills area) and in hills (Orama and Koonamore Hills area)	Precambrian shales and tillites	Oopina	Very shallow skeletal soils
	Stipa nitida – *Bassia* spp. resulting from overgrazing	Plains and hillslopes		Various	
	Erodiophyllum elderi	Flood plains.	Quaternary alluvial deposits	Bindyeye	Gc 1.12 (periodically flooded)
	Zygophyllum aurantiacum	Steep, very rocky slopes and hills.	Precambrian shales and tillites	Hills	Very shallow skeletal soils
Bare areas	-	Lowest point in internal drainage system	Salt pan	Lakes	

CLIMATE

The climate of the area has been examined in detail by Osborn *et al.* (1935). The rainfall averages 7·6 inches per annum (from 50 years of records), but is erratic from year to year, a common feature in arid climates. The mean values for each month (Fig. 2) reveal no distinct seasonal distribution of rainfall, since the area receives falls from the fringes of the southern depression systems in winter, and the northern monsoon systems in the summer. For this reason also, the distribution of rainfall over the area is very uneven, especially when resulting from local thunderstorms.

Throughout the year, mean monthly maximum and minimum temperatures (Fig. 2) show a high diurnal range of as much as 30° F. This accounts for the marked daily fluctuations in relative humidity, often leading to conditions where dew or frost occurs during the night.

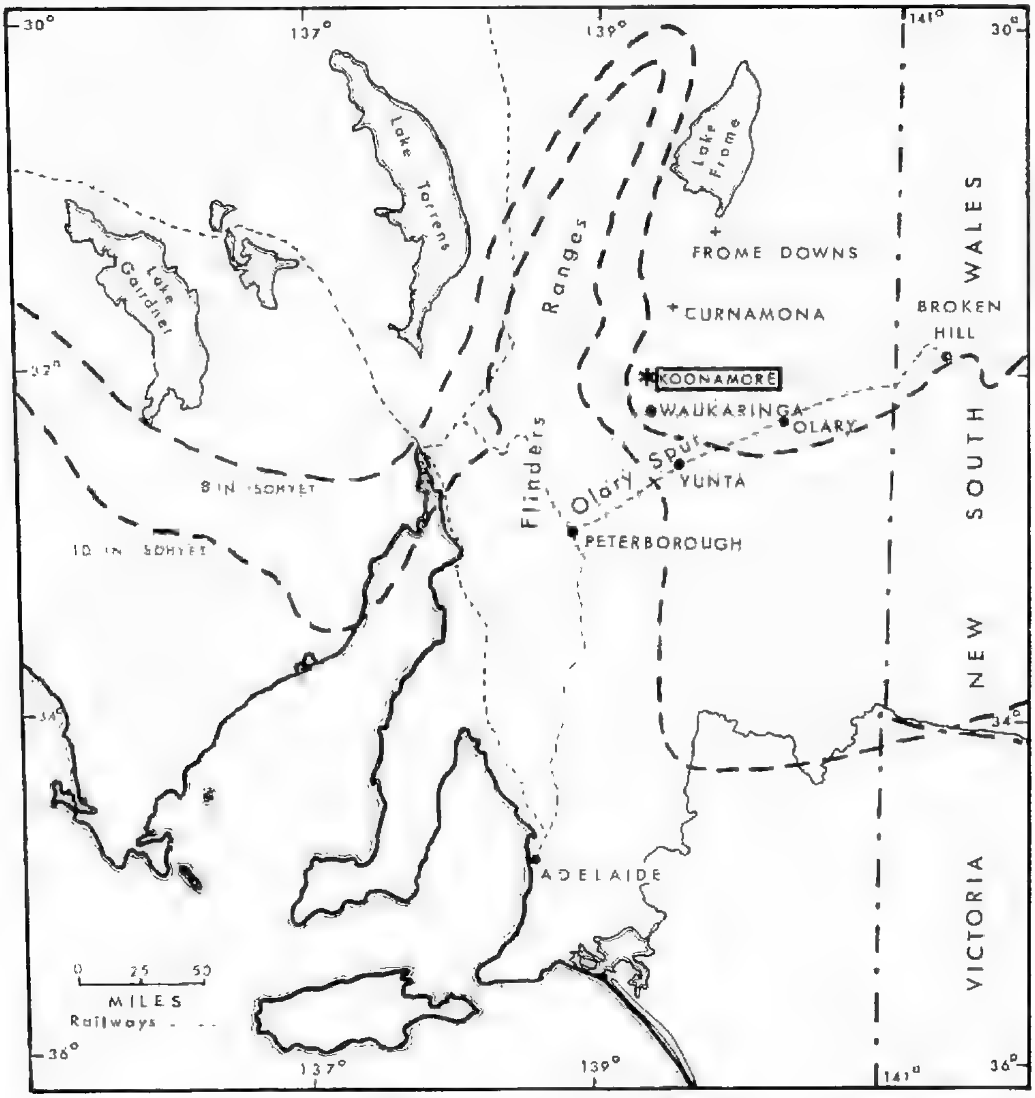

Fig. 1. Locality Map showing the position of Koonamore Station.

LANDSCAPE

Koonamore Station, 500-1,000 feet above sea-level, is situated on a plain sloping gently towards Lake Frome. This plain lies in the angle between the main Flinders Range and the Olary Spur (Fig. 1). The Siccus River, which is generally dry, flows from between these ranges towards Lake Frome and is close to the north-western boundary of Koonamore Station. To the east, the property reaches to the foot of Mt. Victor (1,522 feet); to the south it approaches the Waukaringa Hills, the south-eastern corner extending beyond them (Fig. 3). On the Station, three groups of low hills which are part of the Olary Spur rise out of the plain, namely, the Koonamore, Orama and Oopina Hills (Fig. 3). The slopes are usually gentle, although the hills may have steep rocky ridges, particularly where intrusions of more durable rock occur. Between the hills, ridges of wind-blown sand lie across gently undulating plains of deep alluvial deposits. The underlying rock is a Precambrian shale with intrusions of tillites and massive quartz.

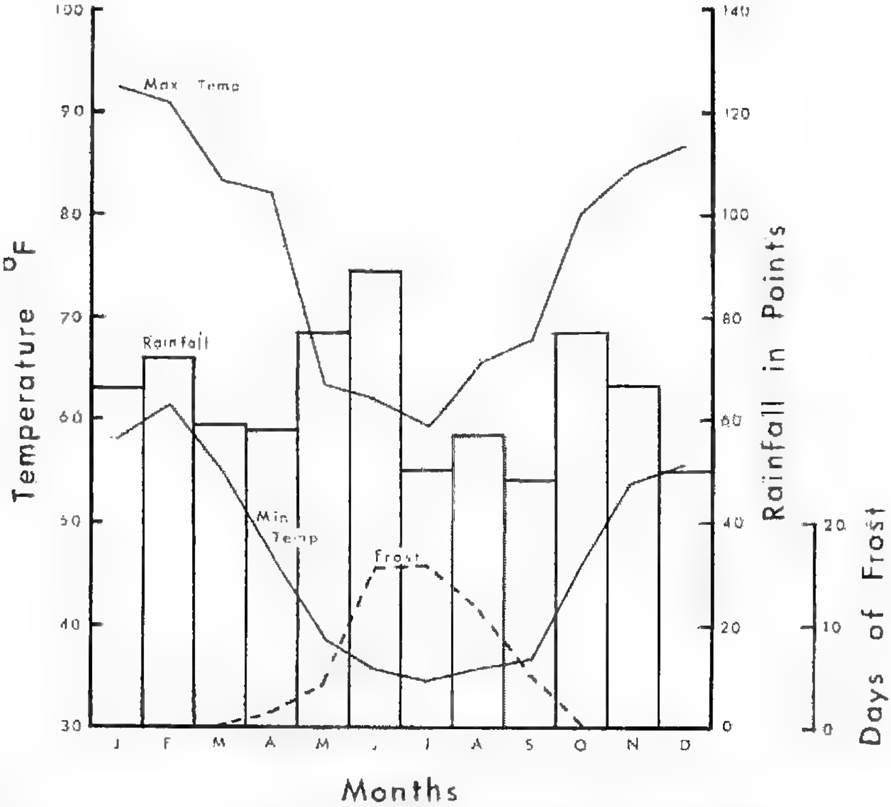

Fig. 2. Mean monthly rainfall, temperature and numbers of frosts at Koonamore Station.

Although some of the drainage water of Koonamore Station eventually finds its way into the Siccus River, the drainage of the area is for the most part internal. Numerous watercourses cross the property, but are dry except immediately following heavy rain. Their channels are often well-defined for considerable distances, then fan out onto flood plains, only to reform into channels further down the gradient. These eventually lead into two salt "lakes" or "pans" which rarely hold water, and lie at the lowest sites on the property; one is in the north-east corner of Hills Paddock and the other in the central west of Milang Cross Paddock (Fig. 3).

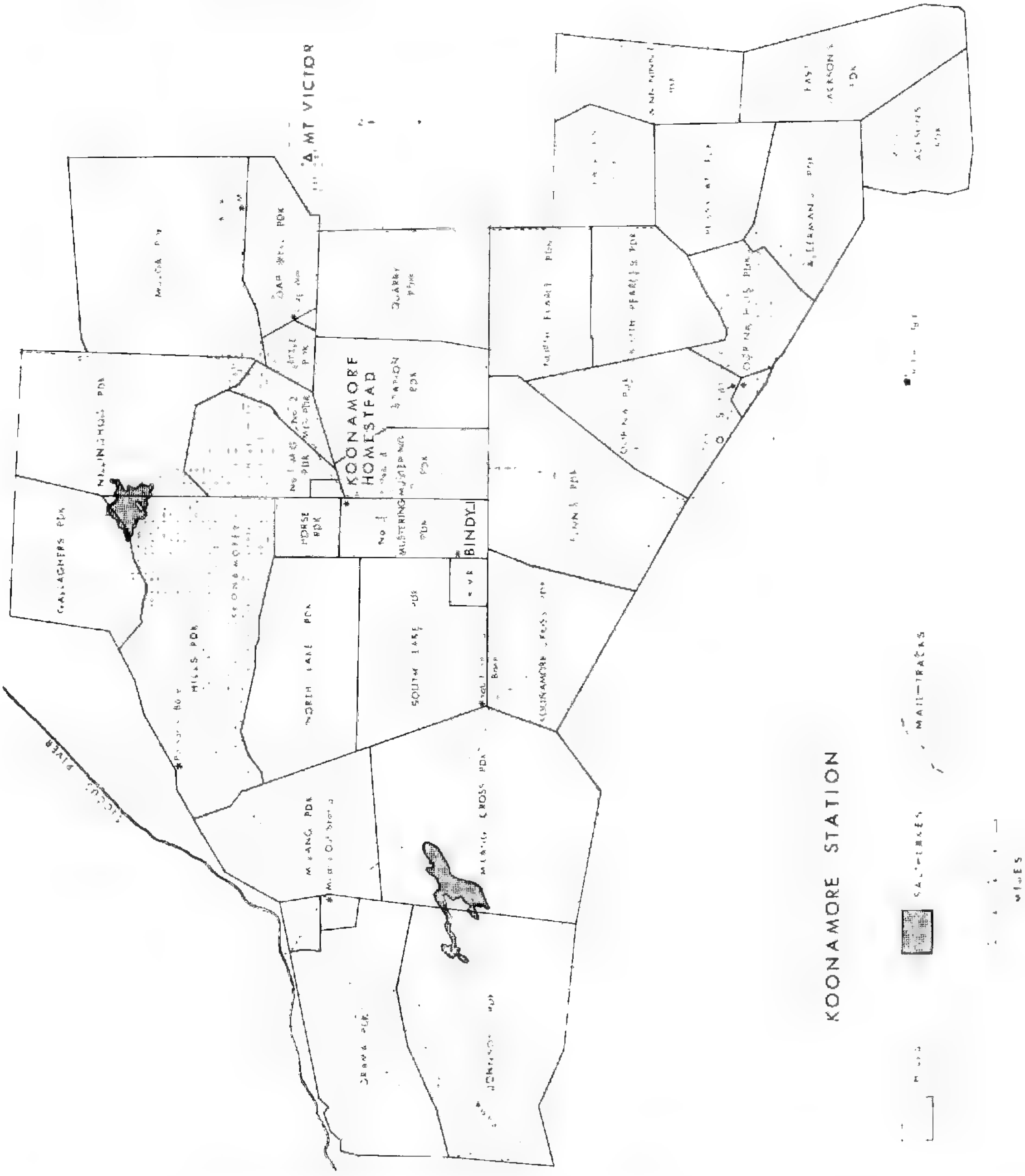

Fig. 3. Map of Koonamore Station showing hills, salt-lakes, paddocks and mail-tracks.

SOILS

1. *Oopina Soils*

The Oopina-Waukaringa Hills and the south-eastern corner of Koonamore Station, and the Orama Hills in the west (Fig. 3), form a distinct landscape of low hills and adjacent rolling plains. Gently-dipping Precambrian shales and tillites have developed a shallow calcareous loamy soil (Um 5·11 of Northcote, 1960) of variable depth. The surface soil,[1] which pulverises when dry, is usually a brown sandy-loam. This grades into a light brown loam at about 9 inches and then into decomposing grey shale. The soil, which contains particles of calcium carbonate throughout, varies in depth from 12 to 36 inches. It supports a shrub steppe form dominated either by *Atriplex vesicaria* on shallow soils or occasionally by *Kochia sedifolia* on sites with deeper soils.[2]

Along broad drainage swales and in pediments at the base of hills, a duplex soil (Dr. 1·33 of Northcote, 1960) has developed. The surface soil,[3] a brown clay-loam, develops a flaky surface crust when dry. Quartz pebbles are often scattered over the surface. No A2 horizon is present and there is a sharp boundary between the A and B horizons The upper 6-12 inches of the B horizon is a red clay which breaks up into shiny-faced peds. This B1 horizon grades into a brown structureless clay which merges into decomposing, often grey, shale. Particles of calcium carbonate, usually present throughout the profile, increase with depth and may form a coating over the parent rock. This soil also supports a shrub steppe form dominated by *Atriplex vesicaria.*

2. *Hills Soils*

These soils are found on Precambrian shales and tillites on the steeper sections of the three main hills systems on Koonamore Station, and may also occur on other low rises where rock outcrops. They are mainly shallow and skeletal, and are coarser textured (gritty clay loam) than the Oopina Soils, often mixed with rock debris, and filling crevices in the rocks from which they are derived. There is no profile development although the soil may be up to four feet in depth. Calcium carbonate particles are usually present in the soil and the underlying rock is often coated with lime.

On the very shallow soils, the environment is unfavourable for perennial vegetation, and the ephemeral species, *Stipa nitida, Bassia* spp., and *Zygophyllum aurantiacum,* a perennial, are chiefly found. But where soil and moisture accumulate along the strike lines and drainage channels, trees of *Casuarina cristata,* and sometimes *Acacia aneura,* and shrubs including *Dodonaea* spp., and *Eremophila* spp., occur. *Kochia sedifolia* is usually found on the minor rocky outcrops, and may extend into the hills where it sometimes constitutes an important element of the shrub layer.

The transition zones between the Hills and Oopina Soils may be extensive and usually carry *Kochia astrotricha.* Thus, there may be large areas of mixed shrub steppe, *Atriplex vesicaria* merging with *Kochia astrotricha,* and this with

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[1] This description refers to a typical profile from the centre of Alderman's Paddock. (For mechanical and chemical analyses see Carrodus, 1962.)

[2] In Oopina Hills Paddock the area shown on the vegetation map (Fig. 4) as a mixture of *Kochia sedifolia* and the almost indistinguishable *K. astrotricha* is not in fact a mixture, but a number of small discrete communities which occupy the scarp and dip faces respectively of the homoclinal hills.

[3] This description refers to a typical profile in the north-western corner of Pussycat Paddock.

K. sedifolia, for example, in the eastern end of Koonamore Cross Paddock. Where the transition is abrupt, there are direct ecotones between *A. vesicaria* and *K. sedifolia*, as in the vicinity of the north-west corner of Johnson's Paddock.

3. *Bindyeye Soils*

Across the centre of Koonamore Station, between the Oopina and the Koonamore Hills, lies a belt of country characterised largely by sand-dunes and sand-plains. These sandy soils all show an accumulation of calcium carbonate nodules in the profile but at varying depth: that of the sand-plain lies no more than a foot from the surface, whereas, in the sand-dunes, the layer may be at a depth of 4-5 feet (Uc 5·11 and Uc 5·12 soils of Northcote, 1960). The sands are buff-coloured (Osborn *et al.*, 1935) except for an area of red sand in a valley enclosed by the Oopina Hills. They support *Eucalyptus oleosa*, *Acacia aneura*, *Casuarina cristata*, *Acacia burkittii*, and *Eremophila sturtii* in either a semi-arid mallee, arid scrub, low arid scrub or low arid woodland sub-form.

Intermingled with and marginal to the sand-dunes are areas of solonized brown soil (Gc 1·12 of Northcote, 1960), in which the texture gradually becomes finer with depth; calcium carbonate is obvious in the shallow surface soil and often becomes cemented in the B horizon into a prominent kunkar layer. These soils in general support a shrub steppe of *Kochia sedifolia*, but occasionally a *Myoporum platycarpum-Atriplex vesicaria* association may occur.

Small low-lying areas of these brown solonized soils may be periodically flooded and then a *Myoporum platycarpum-Eremophila longifolia* association with scattered clumps of *Heterodendrum oleifolium* is characteristic. *Erodiophyllum elderi* often forms a dense ground cover when the water recedes.

The following profile with little limestone is characteristic of the soils from St. Patrick's Paddock (Fig. 3) north and west through North Pearce's into Quarry Paddock: 0-9″ brown sandy clay loam with platy surface, grading into 9-17″, paler sandy clay loam with much nodular limestone; 17-29″ as above, with a marked development of lime nodules; 29-36″ soft decaying shale. (For mechanical and chemical characteristics, see Carrodus, 1962.)

The soil in No. 2 Mustering Paddock differs from that described above only in the presence of powdery gypsum instead of shale in the deeper subsoil. In Station Paddock and south-west through Koonamore Vegetation Reserve, in a lower-lying area than those described above, the lime layer becomes prominent and almost continuous in a pan. It is noteworthy that this pan is penetrable to roots. (For mechanical and chemical characteristics, see Osborn *et al.*, 1931, 1935, and Carrodus, 1962.)

4. *Nillinghoo Soils*

Extending from the northern foothills of the Nillinghoo section of the Koonamore Hills over a small part of the detrital plains to the north, are soils over eight feet in depth, showing obvious stratification of gravelly sandy clay loam, detrital material. Soil-forming processes are apparent, since a gradational profile has developed in which clay increases gradually with depth, and calcium carbonate particles, present but not clearly visible in the A horizon, are obvious as discrete nodules below 12 inches. (For mechanical and chemical analyses, see Carrodus, 1962.) This is a solonized brown soil (Gc 1·22 of Northcote 1960) and is closely related to that in the Bindyeye group of soils (Gc 1·12).

The Nillinghoo Soils support an extensive stand of *Kochia sedifolia* with some *Casuarina cristata* along the watercourses. Towards the lower levels of and *Casuarina cristata*, characteristic of the sand-dunes and plains of the Bindyeye Soils, replace *Kochia sedifolia*.

5. *Curnamona Soils*

In the area of detrital soils to the north of the Koonamore Hills, the duplex Curnamona Soils (probably Dr 1·13 of Northcote, 1960) are widespread, the Nillinghoo Soils being characteristic of a small section only. The Curnamona Soils have developed on the pediments flanking the northern side of the Koonamore and the Orama Hills and extend northwards into Curnamona Station. They support extensive areas of *Kochia astrotricha*, with patches of *Acacia aneura* and *Casuarina cristata*.

6. *Lakes Soils*

The greater part of the drainage from the five groups of soils discussed above flows into the low-lying saline areas where the Lakes Soils occur. They are heavy textured soils containing high concentrations of soluble salts and often have a puffy structure in the A horizon. The soils are either highly saline solonized brown soils (Gc 1·12) or solonchaks (Uf 6·61 of Northcote, 1960), and in the extreme form become covered with a thin layer of salt to produce a salt-pan such as those in Hills and Milang Cross Paddocks.

Apparently, as the amount of sodium salts in the soil increases, the vegetation grades from a shrub steppe of *Kochia pyramidata* through *Nitraria schoberi* to a samphire association of *Arthrocnemum halocnemoides* and *Pachycornia tenuis*, and finally to a bare salt pan.

VEGETATION

The vegetation map of Koonamore Station (see map) shows the distribution of the dominant species of the six vegetation forms or sub-forms: the semi-arid mallee (*Eucalyptus oleosa*), the arid scrub (*Acacia aneura*), the low arid scrub (*Eremophila*, *Acacia*), and the low arid woodland (*Casuarina cristata*, *Myoporum platycarpum*, *Heterodendrum oleifolium*) sub-forms; the five major associations of the shrub steppe form dominated by *Atriplex* (mainly *A. vesicaria*), *Kochia sedifolia*, *K. astrotricha*, *Nitraria-Kochia pyramidata*, and *Arthrocnemum-Pachycornia*; and lastly *Bassia-Stipa* and *Zygophyllum aurantiacum*, dominant species of two associations of the ephemeral herb and grassland sub-form. The structure, composition, and ecological relationships of the vegetation forms and sub-forms are described below and summarised in Table 1.

In addition, the distributions of *Eucalyptus camaldulensis*, along creeks where ground water is nearly always available, and scattered individuals of *Pittosporum phyllíraeoides* are included on the map.

1. *Semi-arid Mallee Sub-form* (*Williams*, 1955).

This sub-form is characterised by a discontinuous stratum of low mallee eucalypt trees (*Eucalyptus oleosa*) up to 8 metres tall (Plate 1, Fig. 1). Scattered chenopodiaceous shrubs and ephemeral species such as *Stipa nitida*, *Salsola kali* and *Bassia* spp. form the lower strata. In this district *E. oleosa* is found at the driest limit of its distribution, being characteristic of the wetter regions further south. This sub-form is, therefore, restricted to deep sandy soils with a well-developed limestone layer in the sub-soil (Bindyeye Soils), along creek beds, and occasionally extending into the hills on rocky slopes (Oopina Soils).

II. *Arid Scrub Sub-form* (*Williams*, 1955)

In this sub-form, a layer of low *Acacia aneura* trees up to 8 metres tall and usually branching near the ground is dominant, and forms a discontinuous stratum ranging from open to dense. Scattered bushes of *Acacia burkittii* or *Eremophila sturtii* may be present in the understorey with a few chenopodiaceous shrubs. After rain, ephemerals like *Stipa nitida*, *Salsola kali*, and *Bassia* spp. may form a continuous ground cover.

The *Acacia aneura* association (Plate 1, Fig. 2) is common on the deep sandy Bindyeye soils which, unlike the soils on which the mallee is dominant, lack a well-developed limestone layer in the sub-soil. This sub-form may also extend into the hills along either drainage lines or steeply dipping strata where soil and water accumulate.

III. *Low Arid Scrub Sub-form*

Shrubs 2-3 metres tall of *Acacia burkittii* and *Eremophila sturtii*, which branch close to the ground to give a rounded, bushy appearance, and form a discontinuous stratum ranging from open to dense, are dominant in this sub-form. Lower strata are usually absent, except for ephemeral plants which may cover the ground after rain. This sub-form is common on some of the low sand-dunes of the Bindyeye Soils (Plate 1, Fig. 3). Where water accumulates along the steep rocky strike-lines of the Koonamore-Mt. Victor Hills, narrow bands of low arid scrub sub-form are dominated by *Eremophila* spp. and *Dodonaea* spp.

Williams (1955) included this sub-form in his "Arid Scrub" sub-form. However, on Koonamore Station these communities are structurally so different from the taller *Acacia aneura* association characteristic of the "Arid Scrub" sub-form, that it seems reasonable to describe them separately.

IV. *Low Arid Woodland Sub-form* (*Williams*, 1955)

When low trees, 4-8 metres tall, with single stems and spreading canopies are common in the landscape, they impart a woodland structure to the community. This is the low arid woodland sub-form (Williams, 1955) and contrasts with the arid scrub sub-form in which the *Acacia aneura* trees usually branch close to the ground, and tend to be bushy in habit. The low arid woodland is dominated by *Casuarina cristata* (Plate 1, Fig. 4), *Myoporum platycarpum* or *Heterodendrum oleifolium*. The canopy of the tree stratum ranges from open, when *Myoporum* is the dominant species, to almost continuous, as exhibited often by *Casuarina* or clones of *Heterodendrum*. Chenopodiaceous shrubs are usually present in the understorey, and ephemeral species appear after rain.

Various associations dominated by one or more of the three species listed above are common on the plains and flood plains of the Bindyeye Soils. The *Casuarina* association extends into the hills, and the *Myoporum* association onto the Lakes Soils (Table 1).

V. *Shrub Steppe Form* (*Williams*, 1955)

This form is dominated by low shrubs usually 0·5-1 metre tall, with semi-succulent leaves, which are usually separated from one another by a distance equal to or greater than the diameter of the plants. Ephemeral species are prominent after rain.

This vegetation form is by far the most common found on Koonamore Station. It includes five major associations (Table 1): *Atriplex vesicaria* association is common on the Oopina Soils (Plate 2, Fig. 5); *Kochia sedifolia* association on the solonized brown soils of the Bindyeye (Plate 2, Fig. 6) and Nillinghoo soil groups, and on Hills Soils; *Kochia astrotricha* association on the Curnamona Soils; *Nitraria schoberi-Kochia pyramidata* association (Plate 2, Fig. 7) and *Arthrocnemum halocnemoides-Pachycornia tenuis* association on Lakes Soils.

The plants of *Nitraria schoberi* may be much larger than the other shrubs, sometimes up to 2 metres tall and several metres in diameter, but are included here for convenience.

VI. *Ephemeral Herb and Grassland Sub-form*

The absence of trees and shrubs, and the presence of a carpet of ephemeral herbs and grasses following rain, are characteristics of the ephemeral herb and grassland sub-form on Koonamore Station, which was not described by Williams (1955). It is common wherever the environment is seasonally too dry for the establishment of perennial vegetation, and hence, perennial herbs and grasses are rarely found. In addition to these areas of presumably natural ephemeral herb and grassland, this sub-form includes disclimax communities resulting from excessive over-grazing of shrub steppe associations. This is evident along the fence separating South Pearce's Paddock from Oopina Hills and Pussycat Paddocks, and along the fence separating No. 3 Mustering Paddock from Finn's Paddock (Plate 2, Fig. 6).

Stipa nitida and *Bassia* spp. usually dominate both the overgrazed areas, and the natural herb and grassland occurring on very shallow skeletal soils along drainage channels and at the base of hills (Plate 2, Fig. 8). *Erodiophyllum elderi* is often dominant on flood-plains of the Bindyeye Soils. For example, the large flood-plain (area 3·5 square miles) extending south-west from Southern Cross Bore into Milang Cross Paddock, is covered with ephemeral herb and grassland apparently dominated by *Erodiophyllum*. On its western margin are clumps of *Muehlenbeckia cunninghamii*. *Zygophyllum aurantiacum*, a perennial, dominates this sub-form on the driest habitats of the Koonamore Hills.

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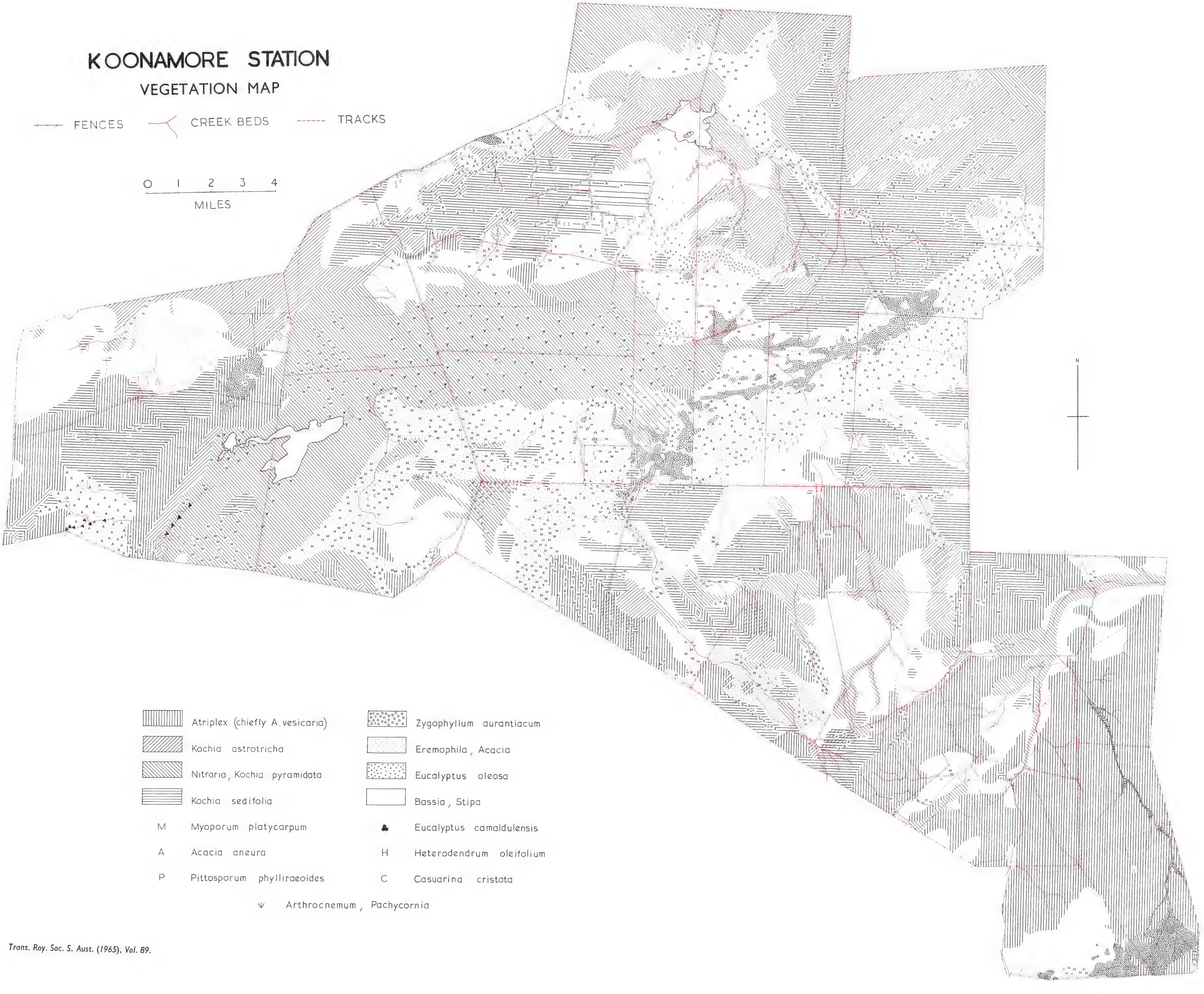

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APPENDIX I

DISTRIBUBTION OF SPECIES RECORDED ON KOONAMORE STATION

The following Table lists the species recorded on Koonamore Station and indicates the habitats in which the species have been found. The data thus presented are by no means complete as the survey was undertaken during the drought period 1960-61. However, the list was supplemented by information gathered by other workers in more favourable seasons.

The identification of many of the specimens was checked by Dr. Hj. Eichler, Mr. P. Wilson and Mr. E. H. Ising of the State Herbarium of South Australia, where a voucher set of specimens has been deposited. The nomenclature follows Black (1943-57) or the forthcoming Supplement thereto, prepared by Hj. Eichler. An asterisk before the species indicates that the plant is an introduction to Australia.

The species have been recorded in the twelve habitats listed below: the numbers preceding each habitat refer to those used at the head of the vertical columns in the Table.

Semi-arid mallee, low arid woodland, arid scrub, low arid scrub sub-forms:

(1) Rocky hills
(2) Creek beds
(3) Sand-hills and sand-plains
(4) Flood-plains

Shrub steppe form:

(5) *Nitraria schoberi-Kochia pyramidata* association (Lakes Soils)
(6) *Arthrocnemum halocnemoides-Pachycornia tenuis association* (Lakes Soils)
(7) *Atriplex vesicaria* association (Oopina Soils)
(8) *Myoporum platycarpum-Atriplex vesicaria* association on Solonized brown soils (Bindyeye Soils)
(9) *Kochia astrotricha association* (Curnamona Soils)
(10) *Kochia sedifolia* on Solonized brown soils (Bindyeye Soils)
(11) *Kochia sedifolia* on Solonized brown soils (Nillinghoo Soils)

Ephemeral herb and grassland sub-form:

(12) *Stipa nitida-Bassia* spp. association.

The following species have been recorded on Koonamore Station but no details regarding their ecological distribution are available.

Danthonia penicillata, *Enneapogon nigricans*, *Tragus australianus*,
Atriplex lindleyi, *Atriplex velutinella*. *Helipterum variabile*.
Acacia tetragonophylla, * *Vella annua*.

Species	1	2	3	4	5	6	7	8	9	10	11	12
Family Polypodiaceae												
Cheilanthes lasiophylla	+	—			—		—	—	—		—	—
Pleurosorus rutifolius	+	—	—	—	—		—	—		—		
Family Marsileaceae												
Marsilea			—	+								
Family Gramineae												
Cymbopogon exaltatus		+	—	—	—	—	—	—	—	—		—
Dactyloctenium radulans	—	—	—	+	—	—	—	—	—	—	—	—
Enneapogon arenaceus	—	—						—	+			—
E. cylindricus												
E. polyphyllus			—	—	—	—	—		+			—
Eragrostis dielsii			—	—	—							—
*Schismus barbatus	+	+	—	—	—	—	+	+	—	—	—	—
Stipa nitida		—	+	+			+	+	+		—	+
S. platychaeta	—	—			+		—					
Triodia irritans			+			—	—		—		—	—
T. longiceps (?)		—	—	—	+	—	—			—		—
Triraphis mollis	—			—	—	—	—		+	—	—	—
**Trisetum pumilum*			+	—				—				
Family Liliaceae												
**Asphodelus fistulosus*†		+	—	+	—	—	—	—	—			—
Family Casuarinaceae												
Casuarina cristata	+	+	+	—								
Family Urticaceae												
Parietaria debilis	—	—	—	+							—	
Family Proteaceae												
Hakea leucoptera	+		—	—	—	—	—	—				—
Family Santalaceae												
Eucarya acuminata			+									
E. spicata		—	+									
Exocarpos aphyllus			+	—		—	—	—	—		—	
Santalum lanceolatum			+	+	+	—	—	—				—
Family Loranthaceae												
Amyema maidenii	+	+	+									
A. pendula	—		+			—						
A. preissii		—	+		—	—	—		—		—	—
Lysiana exocarpi	+		+	+	—	—	—		—			—
Family Polygonaceae												
Muehlenbeckia cunninghamii					—							
**Rumex vesicarius*				+								
Family Chenopodiaceae												
Arthrocnemum halocnemoides var. *pterygospermum*						+		—	—	—		
Atriplex angulata	—	—	—	—	+	+		—		—	—	—
A. eardleyae	—	—	—	+	—	—	—	+				
A. inflata	—	—	—	—	+	—	—	—				
A. spongiosa					+		+	—		—		
A. stipitata			+					+		—		—
A. vesicaria	+	+	+	—	+	—	+	+		—		—
Babbagia acroptera			—	—	—	+	+	—	+			—
Bassia bicornis	—	—	—	—	—	—	—	—	—	—		
B. brachyptera				+			+			—		
B. diacantha			+									
B. divaricata	+	—	+	+	—	—	—	—		+	+	—
B. lanicuspis	—			—		—	—	—		+		
B. limbata	—	—	—	—	—	—	—	—	—	—	—	
B. obliquicuspis							+			+	—	
B. paradoxa			+	+				+		—		+
B. patenticuspis	—	—	+	+	—	—	+	+	—	+		+
B. sclerolaenoides			—	+	—			—	—	+		
B. ventricosa	—	—	—	—	—	—	+	—	—	—	—	
Chenopodium cristatum			+					+		—	—	
C. pumilio		+								—		
Enchylaena tomentosa	+	—	+	—	+	—	—	—	—	+		—
Kochia aphylla			—	—	—	—	—	—	+			
K. astrotricha	+	—	—	—	—	—	—	—	—	—	—	—
K. brevifolia				—		—				—	—	
K. cannonii					+							
K. ciliata	+	—	—	—	—			+	+	—	—	+
K. erioclada	+		+	—				—	—	—	—	
K. excavata			—	—	—		—	—	—	+	—	—
K. georgei						—	—	+				—
K. lobiflora						—	—	?				+
K. pyramidata	+	—			+		—	—	—	—		
K. sedifolia	+							—		+	+	
K. tomentosa				+						—		
Pachycornia tenuis				—		+			—			—
Rhagodia gaudichaudiana	—		—	—	—	—	—	+	+	+		
R. spinescens var. *deltophylla*	+	—		+	+	—			—			
Salsola kali			—		+		+	+		+		

†Roark (1955) reported an invasion of this weed into the *Nitraria schoberi* community on the southern boundaries of Milang Cross and Johnson's Paddocks.

Species	1	2	3	4	5	6	7	8	9	10	11	12
Family Amaranthaceae												
Amaranthus sp.	—				—	—	—	—	—	—	—	
Ptilotus nobilis	+		+			—	—	—	—	—	—	—
P. obovatus	+	—		+			—					
P. polystachyus	+			—								
Family Nyctaginaceae												
Boerhavia diffusa	—	—	—	+	—	—	+			—	—	
Family Aizoaceae												
Tetragonia eremaea	—	+	—	+	+		+	+	+	+	+	—
Trianthema triquetra	—			+	—	—		—	—	—	—	—
Family Portulacaceae												
Calandrinia eremaea	—	—										
Portulaca oleracea		+			—						—	
‡Family Cruciferae												
Blennodia blennodioides		—	—	—		—		?				—
B. trisecta	—	—		—	—		—	?	—	—	—	—
**Diplotaxis tenuifolia*				+	—	—	—			—	—	—
Geococcus pusillus		—		—			—		—	—		
Stenopetalum lineare			+					+				
Family Resedaceae												
**Reseda luteola*	—			+								
Family Crassulaceae												
Crassula colorata		—	+	—	—			—	—		—	
C. sieberiana			+									
Family Pittosporaceae												
Pittosporum phylliraeoides	+		+		+	—		—			—	—
Family Leguminosae—Mimosoideae												
Acacia aneura	+	+	+									
A. burkittii	—		+									
A. carnei		+	—		—	+	—	—			—	
A. ligulata	+					—					—	—
A. oswaldii												
A. salicina	+											
A. stenophylla	—	—	+									
A. victoriae	—	+	+			—			—	—	—	
Family Leguminosae—Caesalpinioideae												
Cassia artemisioides	+	—										
C. nemophila	—	—	+	+				+			—	+
C. phyllodinea	—		—	+	—	—	—	—	—		—	—
C. sturtii	—	—	+	+	—	—	—	+	—	+	—	—

Species	1	2	3	4	5	6	7	8	9	10	11	12
Family Leguminosae—Papilionatae												
Clianthus formosus	—		+	+					—	—	—	—
Lotus cruentus	—	—		+	—	—	—	—		+		
**Medicago denticulata*	—	—	—	+	—	—	—	—				
Psoralea patens	—	—	—	+					—	—	—	—
Swainsona phacoides		+						—	—	—		
Templetonia egena				+	—		—		—			—
Trigonella suavissima				+						—	—	—
Family Geraniaceae												
Erodium crinitum	—		+	—			+					
E. cygnorum ssp. *glandulosum*	+	+	+	+	—		+	+	+	+	+	+
Family Oxalidaceae												
Oxalis corniculata	+			—	—	—	—		—	—		—
Family Zygophyllaceae												
Nitraria schoberi				+	+			—			—	—
Peganum harmala			—	—	+							
Tribulus occidentalis	—	—	—	+	—	—	—	—	—	+	—	—
Zygophyllum ammophilum		+	+			—		—	—	—	—	—
Z. aurantiacum	—				+	—			—			
Z. billardieri			—			—	—	—	—	—	—	—
Z. crenulatum				+								
Z. iodocarpum		+		+								
Z. ovatum	—	—		+				+				
Z. prismatothecum		—		+	+	+		+				
Family Rutaceae												
Eriostemon linearis	+											
Family Euphorbiaceae												
Euphorbia drummondii	+		+				+	+		+		+
E. eremophila	—						+					
Phyllanthus rigens	—											
Family Sapindaceae												
Dodonaea attenuata		—	+	—		—	—	—	—	—	—	—
D. lobulata	+	—				—						
D. microzyga	+											
Heterodendrum oleifolium	—		+	+				+	+	+		+
Family Malvaceae												
Abutilon fraseri	—	—	—	+	—	—	—	—	—	—	—	—
Lavatera plebeja		—	+	—	—				—	—	—	—
Malvastrum spicatum				+								
Sida corrugata			—	+	—							
S. fibulifera (?)	—	—	—	+	—	—	—	—	—	—		
S. intricata			—	+	—	—	—	—	—	—	—	—
S. petrophila	+											—

‡ Modified by E. A. Shaw, A critical revision of some endemic Australian genera of Cruciferae. Trans. Roy. Soc. S.A. (Vol. 89, p. 145).

Species	1	2	3	4	5	6	7	8	9	10	11	12
Family Myrtaceae												
Eucalyptus camaldulensis†	—	+	—	—	—		—	—	—	—		
E. oleosa	+	+	+	—	—	—	—	—	—	—	—	—
Melaleuca lanceolata	—	+		—	—	+	—	—	—	—	—	—
Family Umbelliferae												
Daucus glochidiatus	—	—	+	—	—	—	—	—	—		—	—
Family Asclepiadaceae												
Marsdenia australis	+			—	—		—	—	—	—	—	—
Sarcostemma australe					+							
Family Convolvulaceae												
Convolvulus erubescens	—	—	—	+	—	—	+	—	—	+		
Family Boraginaceae												
**Echium lycopsis*	+	+	+	+	—		+	—	+	—	+	+
**Heliotropium europaeum*	—	—	—	+	—	—	+	—	—	—	—	
Lappula concava	—	—	+	—	—			—				
Omphalolappula concava		—	+	—	—	—	—	—	—	—	—	—
Plagiobothrys plurisepalus	—		+	—			—	+	—	—	—	
Family Verbenaceae												
Verbena supina			—	+	—			—	—	—	—	—
Family Labiatae												
Prostanthera striatiflora	+			—	—	—	—		—	—	—	—
Teucrium racemosum	—	—	—	+								
Family Solanaceae												
Lycium australe	—	—	—	+	—	—	—	+	+	—		
**Nicotiana glauca*	+	—	—	—	+	—	—	—	—	+	—	—
N. goodspeedii				+	—	—	—	—	—	—		
Solanum ellipticum	—	—	—	+		—			—			+
**S. nigrum*	—	—		+	—	—	—	—	—	+	—	
S. sturtianum	+	—	—	—	—	—		—	—	—	—	—
Family Myoporaceae												
Eremophila alternifolia	+											
E. duttonii		—		+	—	—	—	—	—	—		—
E. freelingii	+	—	—	—	—		—		—	—	—	—
E. longifolia	—		—	+	+	—	—	—	—	—		
E. maculata	—	—	—	+								
E. oppositifolia	+	—	—									
E. scoparia	—	—	+	—	—	—	—	+	+	+	+	—
E. serrulata	+			—	—	—	—	—	—	—		
E. sturtii			+	+				+	—	—	—	
Myoporum platycarpum	+	—	+	+	+	—		+	—	+		+
Family Cucurbitaceae												
Citrullus lanatus	—	—	—	+	—	—	—	—	—	—	—	—
Cucumis myriocarpus				+	—			—		+		

†Creekbeds in Johnson's Paddock and along Siccus River north of Orama Paddock.

Species	1	2	3	4	5	6	7	8	9	10	11	12
Family Campanulaceae												
Wahlenbergia bicolor	—	+	—	+	—	—	—	—	—	—	—	—
W. consimilis	—	—	—	+	—	—	—	—	—	—	—	—
W. sieberi		—		+	—	—	—			—		
Family Goodeniaceae												
Goodenia subintegra	—	—	—	+	—	—	—	—	—	—	—	—
Family Compositae												
Angianthus burkittii		—	+	+	—	—	—	—	—	—	—	—
Brachyscome pachyptera	—	—	—			—		+	—	—	—	—
Calotis cymbacantha	—	—	?	—	—	—	—	—	—	—	—	—
C. hispidula	—	+	+	—	—	—	—	—	—	—		+
**Carthamus lanatus*				+				—	—	—	—	—
Cassinia laevis	+	—	—	—	—	—	—	—	—	—	—	—
**Centaurea solstitialis*				+		—	+	—	—	+	+	—
Craspedia pleiocephala	—	—	+	+	—	—	—	—	—	—	—	—
Erodiophyllum elderi	—		+	+	—	—						
Gnaphalium luteoalbum			—	+	—				—	—		—
Gnaphalodes uliginosum	—	—	+	—	—	—	—	—	—		—	—
Helipterum floribundum		—	—	+	—	—	—	—	—	—	—	—
H. moschatum	—	—	+	—	—	—	—	—	—			
H. strictum	—			+			—	—	—	—	—	—
**Inula graveolens*		—	—	+	+	—	—	—	—	—	—	—
Isoetopsis graminifolia	+		+	—	—	—		—	—	—	—	+
Ixiolaena leptolepis		—	+	—	—	—	—	—	—	—	—	—
Millotia macrocarpa	—		+	—	—	—						
M. myosotidifolia			+									
Minuria cunninghamii	—		—		+	—	—	—	—	—	—	—
Olearia pimeleoides	—	+	—	—	—	—	—	—	—	—	—	—
Podocoma nana	—	—	—	+	—	—	—	—				
Pterocaulon sphacelatum	+	+			—				—		—	—
Rutidosis multiflora			+	—				+			—	—
Senecio anethifolius	+	—	—	—	—	—	—	—	—	—	—	—
S. gregorii	—	—	+									
S. magnificus	—	+	—	—	—		—	—			—	—
S. quadridentatus			—	?	—		—		—	—	—	
**Sonchus oleraceus*	—	—	+	+	—	—		—	—	—	—	—
Toxanthes muelleri	—	—	+									—
Vittadinia scabra		—		+	—	—	—	—			—	—
V. triloba		—	—	+		—	—	—	—	—	—	
**Xanthium spinosum*	—	—	—	+	—	—	—	—	—	—	—	—

APPENDIX II

POPULAR NAMES OF SOME BETTER-KNOWN PLANTS FOUND ON KOONAMORE STATION

Scientific Name	*Popular Name*
Acacia aneura	Mulga
Arthrocnemum halocnemoides	Samphire
Atriplex vesicaria	Bladder Saltbush
Bassia—various species	Bindyeye
Casuarina cristata	Black Oak
Dodonaea spp.	Hop Bush
Eremophila sturtii	Turpentine Bush
Eremophila longifolia	Long-leaved Eremophila, Emu Bush
Erodiophyllum elderi	Koonamore Daisy
Eucalyptus camaldulensis	River Red Gum
Heterodendrum oleifolium	Bullock Bush
Kochia pyramidata	Black Bluebush
Kochia sedifolia	Bluebush
Muehlenbeckia cunninghamii	Lignum
Myoporum platycarpum	False Sandalwood
Nitraria schoberi	Nitre-bush
Pachycornia tenuis	Samphire
Pittosporum phylliraeoides	Native Willow
Salsola kali	Roly-poly
Stipa nitida	Spear Grass
Zygophyllum spp.	Squash Bush

EXPLANATION OF PLATES

PLATE 1

Fig. 1. Semi-arid mallee, *Eucalyptus oleosa* association on Koonamore Station.

Fig. 2. Arid scrub, *Acacia aneura* association on Koonamore Station.

Fig. 3. Low arid scrub, *Acacia burkittii-Eremophila sturtii* association on Koonamore Station.

Fig. 4. Low arid woodland, *Casuarina cristata* association on Koonamore Station.

PLATE 2

Fig. 5. Shrub steppe, *Atriplex vesicaria* association on Koonamore Station.

Fig. 6. Shrub steppe, *Kochia sedifolia* association on Koonamore Station with overgrazed community (during drought) on right.

Fig. 7. Shrub steppe, *Nitraria schoberi* association on Koonamore Station.

Fig. 8. Ephemeral herb and grassland, *Stipa nitida-Bassia* spp. association on Koonamore Station; *Myoporum platycarpum* trees in the background.

1

2

3

4